



Eric van Oorschot Side Impact Systems Integration

www.tass-safe.com

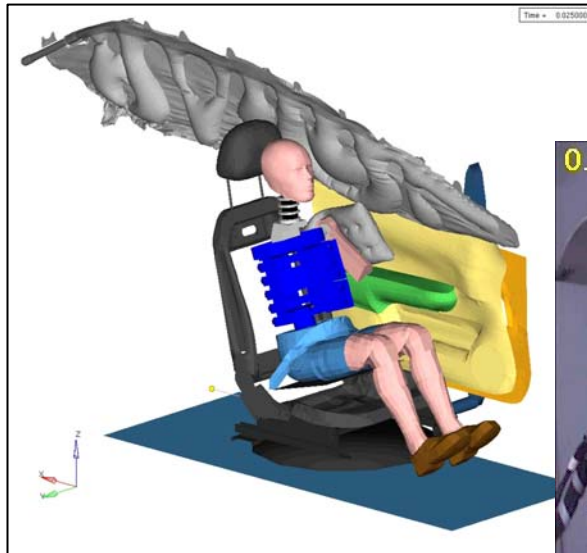
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Contents

- Systems Integration
- TASS Side Impact methodology
- Sled testing
 - tool development
 - test set-up
 - example: IIHS
- Conclusions

Systems Integration

- Goal
 - meet customer requirements of restraint systems for minimal cost using the optimal combination of tools



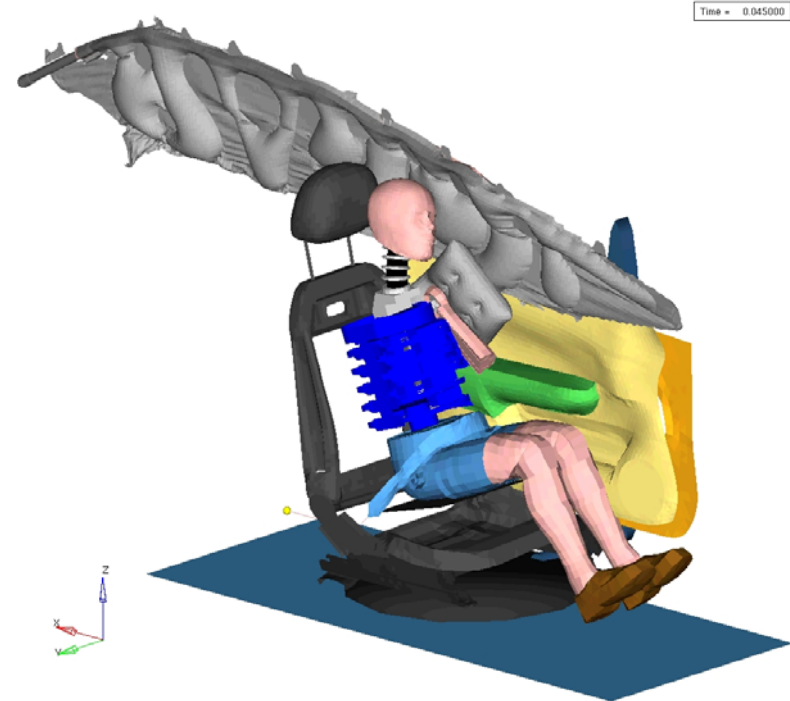
Systems Integration

- Full scale testing
 - Inevitable for verification & homologation
 - Limited availability during development
 - Expensive



Systems Integration

- Application of numerical tools for occupant safety
 - Concept phase
 - Parameter studies
 - Frontal applications
 - – high reliability
 - Side impact applications – medium/low reliability
 - Interaction between dummy, interior and airbags not yet engineering ‘standard’



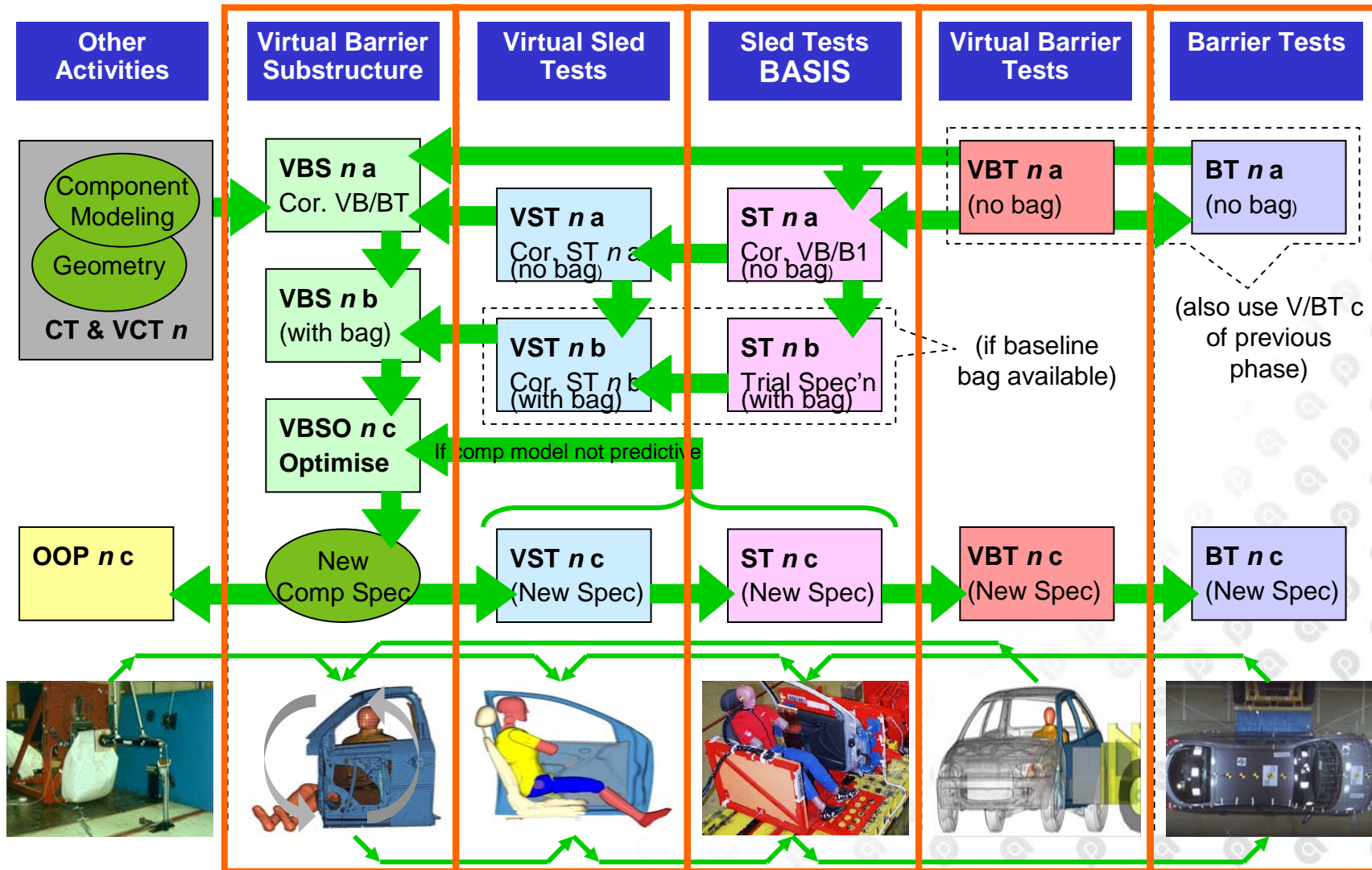
- Sled testing
 - Fills the gap between numerical tools and full scale testing
 - Simplification of full scale test
 - Multi-dimensional phenomena represented by a one or two dimensional phenomena
 - Essential tool for validation of numerical models
 - Realistic unfolding of the airbag during contact with dummy and interior
 - Verification of recommended designs from numerical tools



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TASS Side Impact methodology



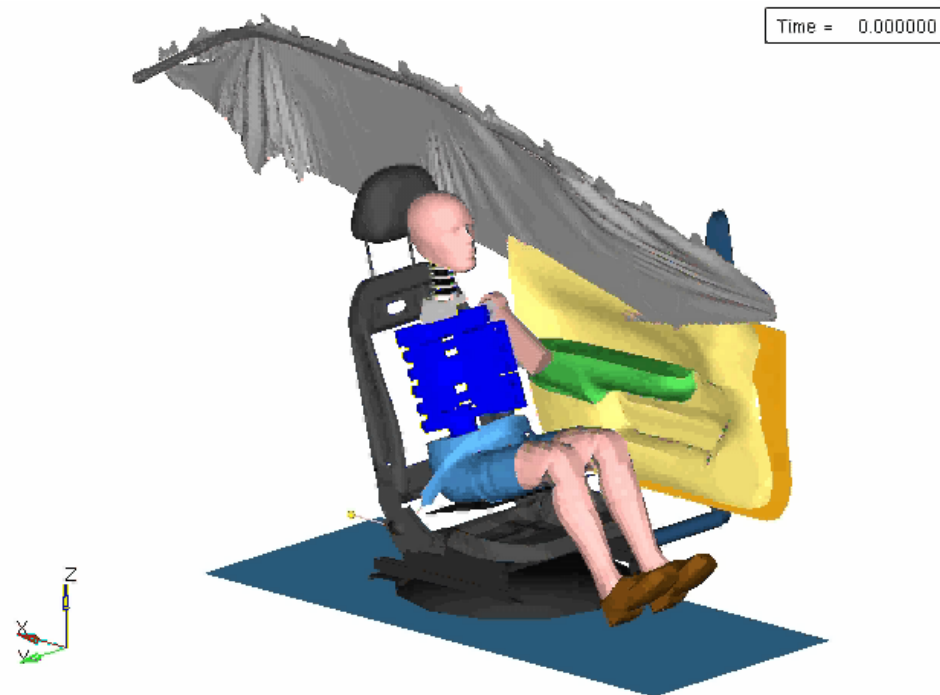
TASS Side Impact methodology

- Full Scale Testing
 - matured technology



TASS Side Impact methodology

- Numerical CVS tools
 - sled models for component validation
 - full vehicle models using PSM for DoE
 - emerging technology



TASS Side Impact methodology

- Sled testing
 - new technology



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Sled testing – tool development

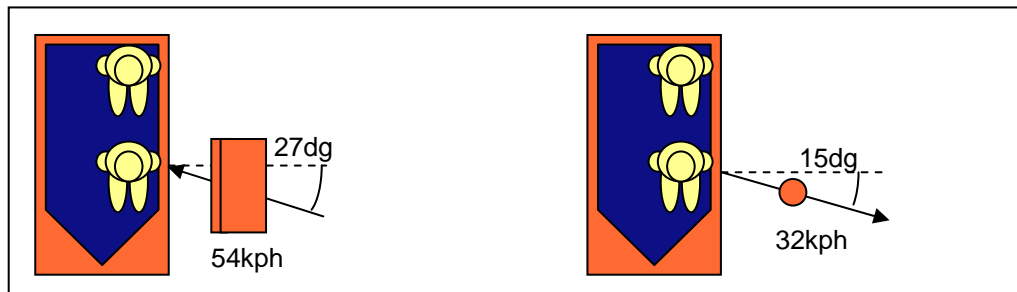
- Goal tool development:
 - fill in the gap between numerical modeling and full scale testing
 - realistic unfolding of a side/curtain airbag
 - door trim velocities match the measured velocities in the full scale test
 - gap closure matches gap closure in full scale tests
 - exact representation of injury values in full scale **not** required
 - similar trends required in full scale and sled testing

- Approach
 - accelerate the door/roof rail/B-pillar
 - mount the seat on a separate sled

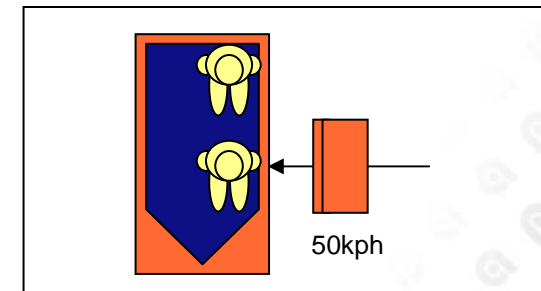
Sled testing – tool development

Test configurations

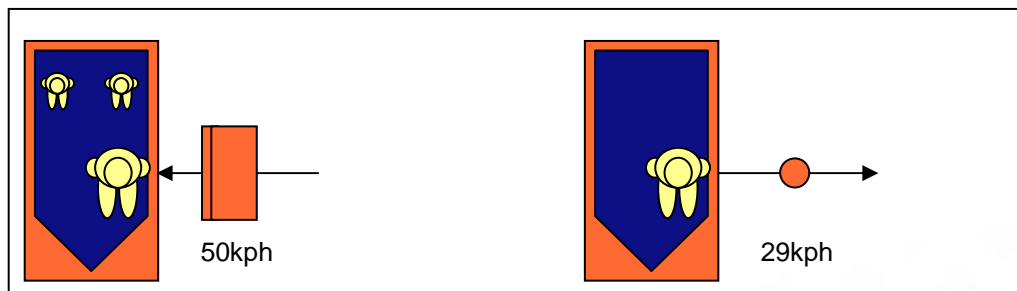
FMVSS 214 NPRM (ES2re)



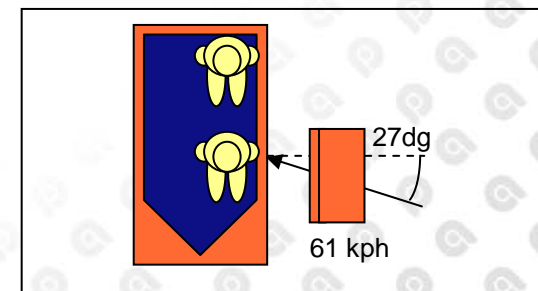
IIHS (S-IIs)



EuroNCAP (ES2)



SINCAP (DS)



EuroNCAP Barrier



NPRM 214 pole



NPRM 214 Barrier



IIHS



EuroNCAP Pole



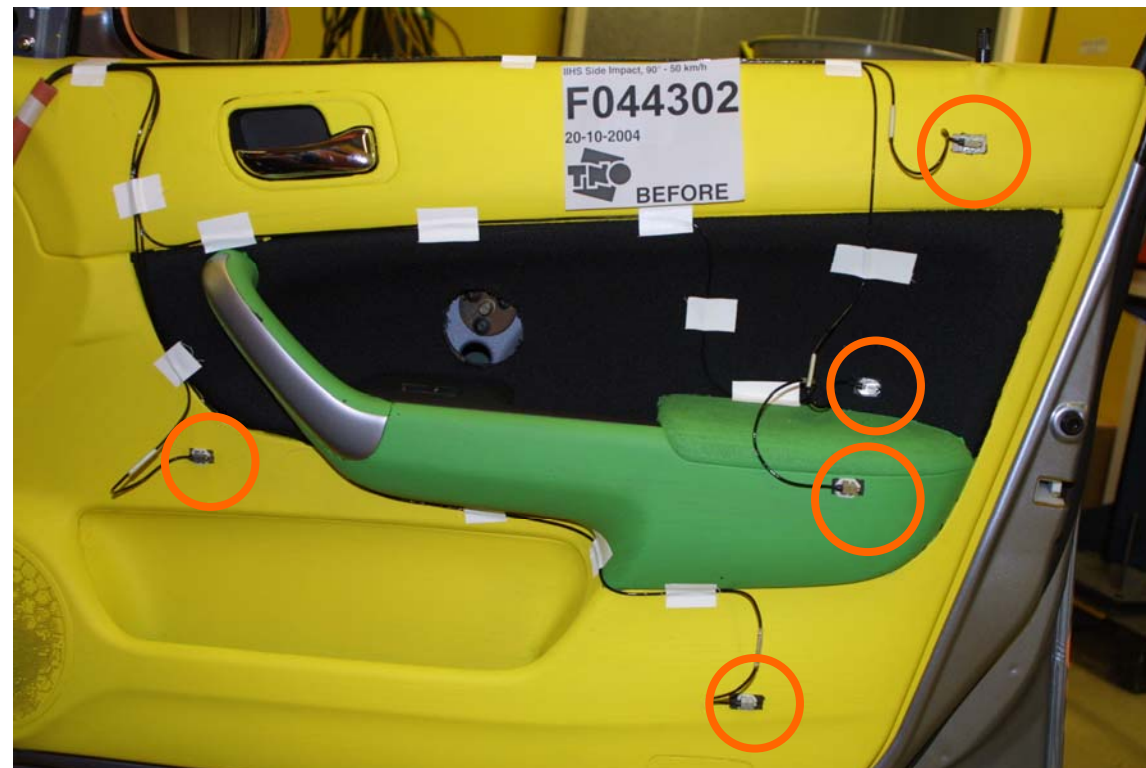
US NCAP side

Sled testing – tool development



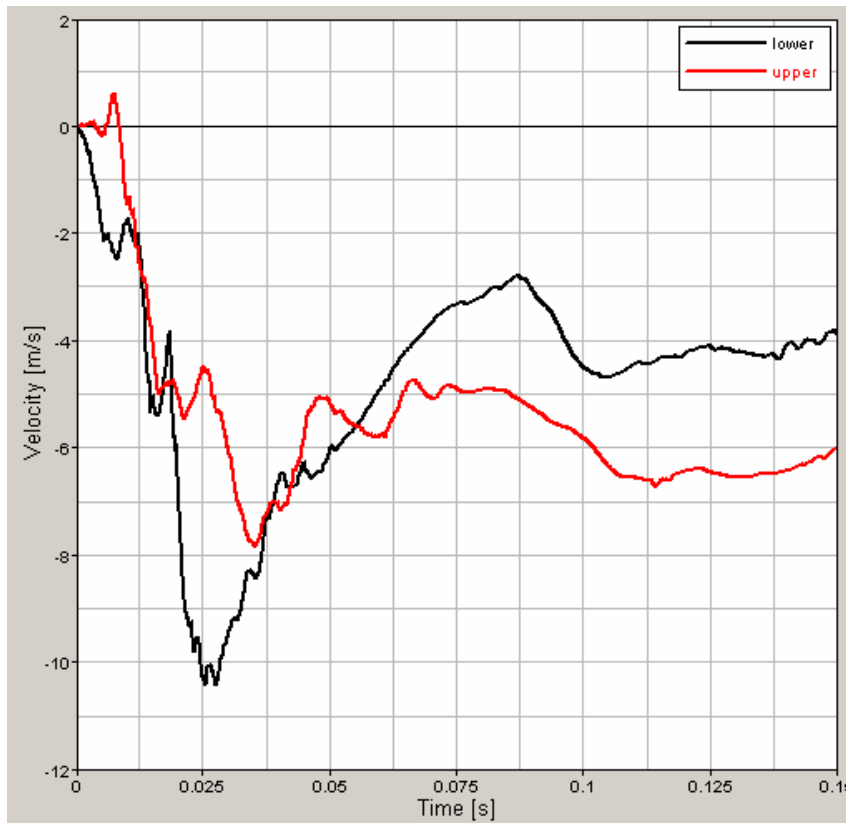
Sled testing – tool development

- Accelerometer on the door trim
velocity calculated



Sled testing – tool development

EuroNCAP barrier impact (velocity vs. time)



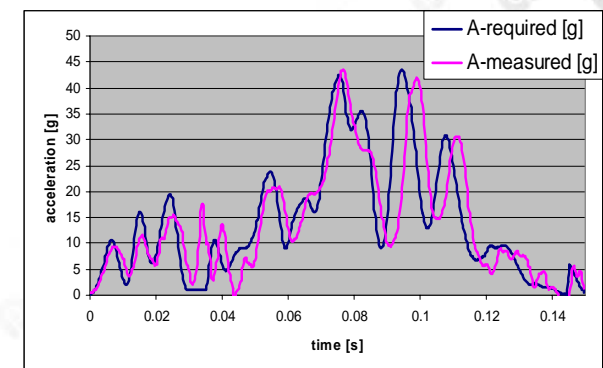
- difference in door velocity at recliner level (black) and waistline level (red)
- sled testing: one velocity
- decide prior to sled testing what body part to focus on

Contents

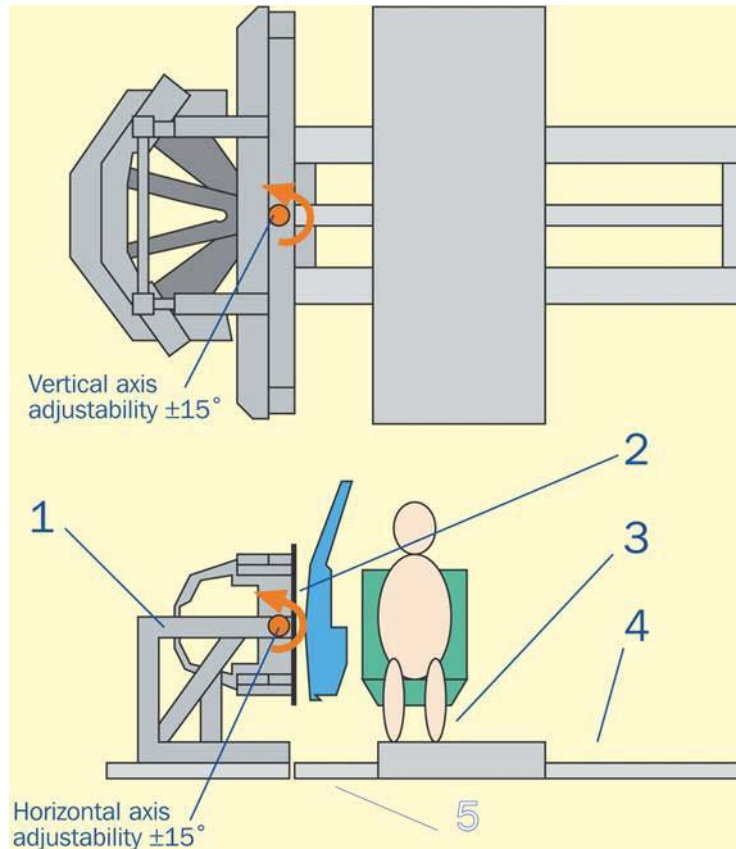
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Sled Testing – test set-up

Maximum force	: 4000 kN
Maximum payload	: 2500 kg
Maximum acceleration	: 100 g
Minimum acceleration	: ~5 g
Maximum velocity	: 72 km/h
Maximum stroke	: 1650 mm
Maximum pulse duration	: 200 ms
Sledge dimensions	: 4000 x 2200 mm
Hydraulic brake system	: -50 g (800 kg)



Sled Testing – test set-up



Break Assisted Side Impact Sled (BASIS)

1. sled base
2. pivot to mount door in a pre-set angle
3. seat mounting plate
4. guide rails for seat mounting plate
5. crumple tubes between sled base and seat mounting plate

Sled Testing – test set-up

- Sled pulse based on full scale test only
- Trim panel / inner panel support depends on crash mode
 - Pole – fully supported
 - IIHS – lower section supported
- Door X-rotation depends on shape of incoming door

Sled Testing – test set-up

- Maximum of 2 correlation tests before good correlation was achieved
- Correlation parameters:
 - timing of the sled pulse (**not the pulse shape !**)
 - crumple tube characteristic
 - door orientation (X-rotation)

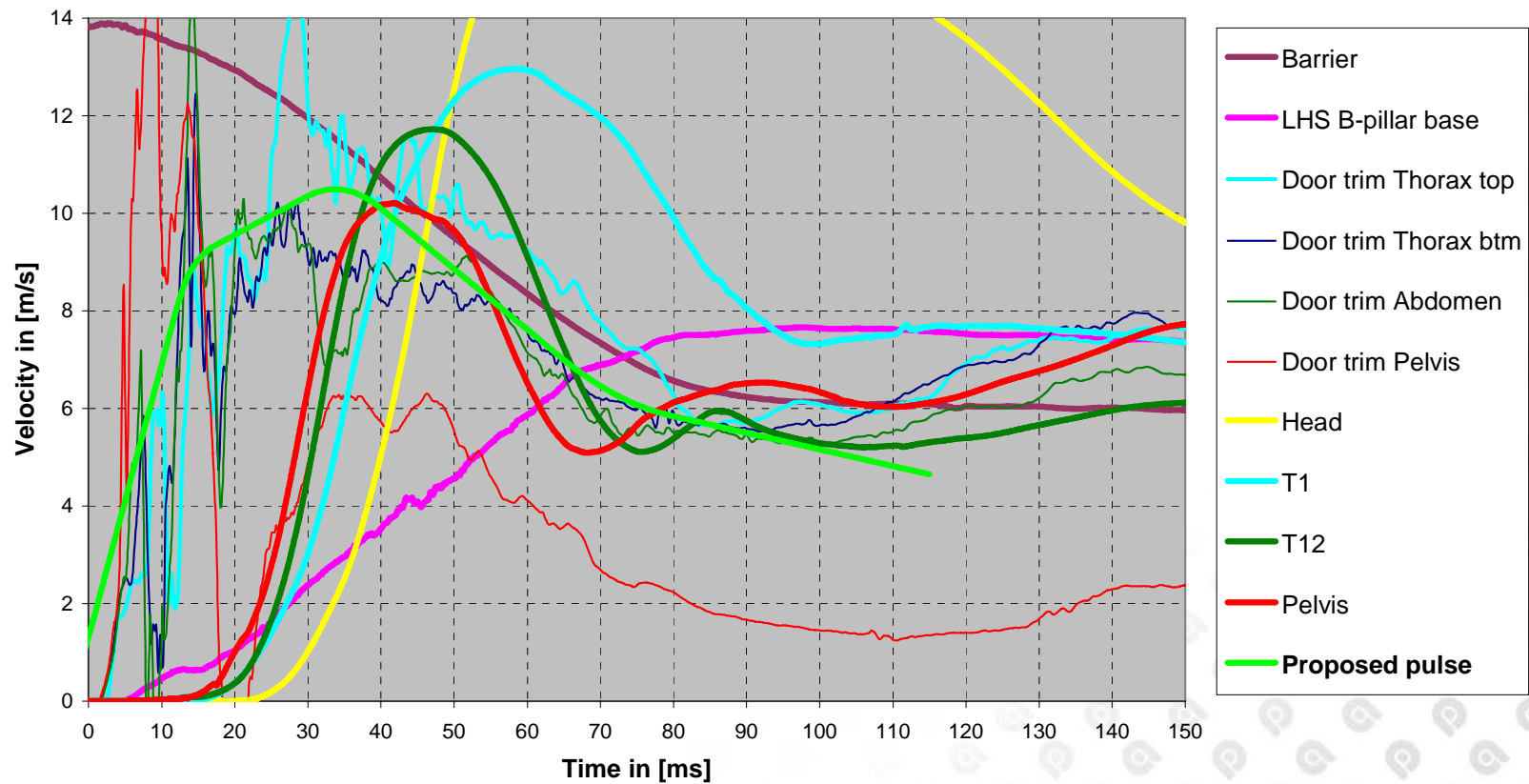
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Sled Testing IIHS

IIHS full scale test F044302

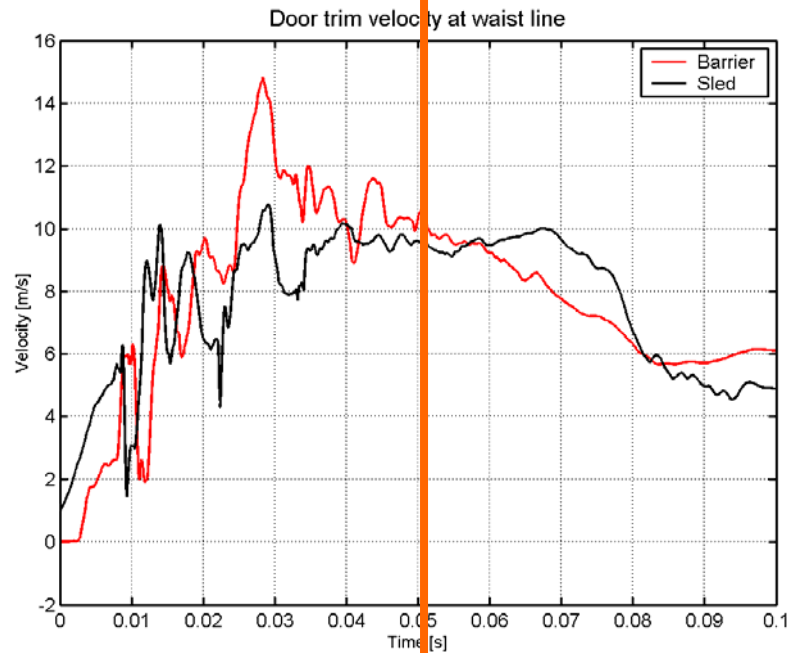
Dummy SID II s (forward position)



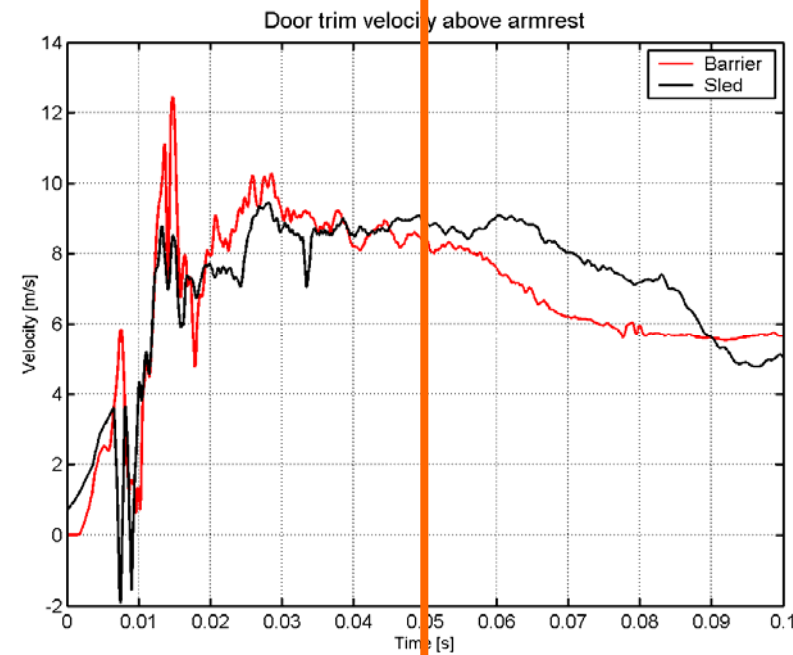
Sled Testing IIHS



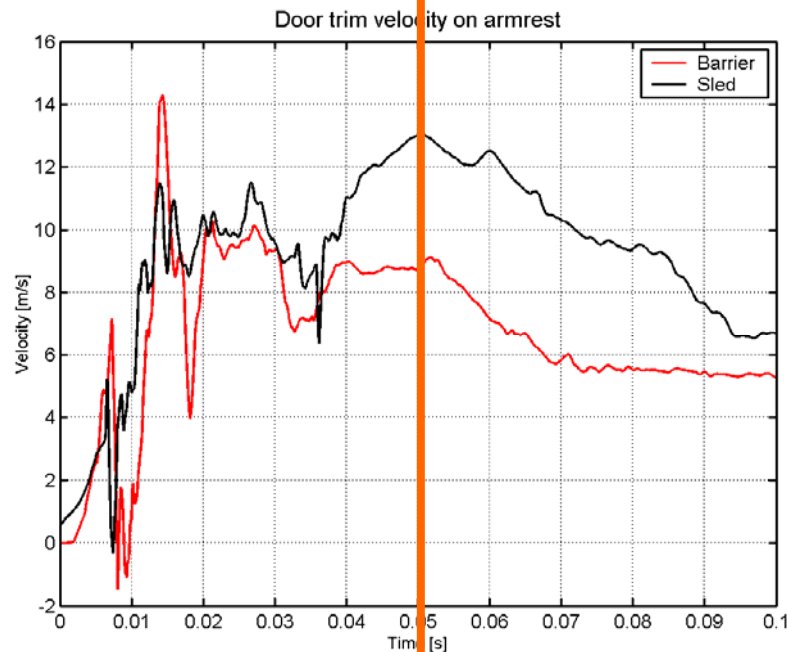
Sled Testing IIHS



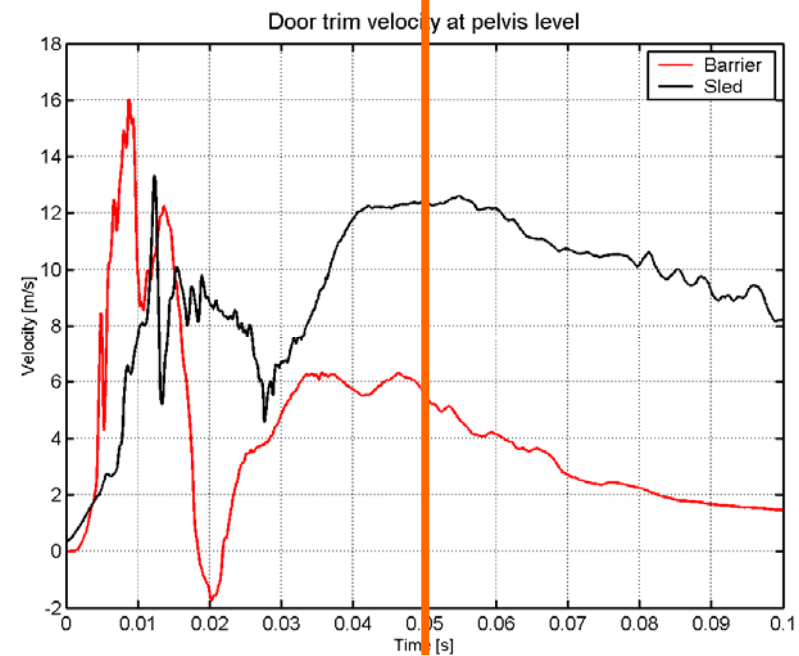
- Velocity vs. time
 - black = sled test
 - red = full scale test
- ◀ waistline level
- ▼ door trim above armrest



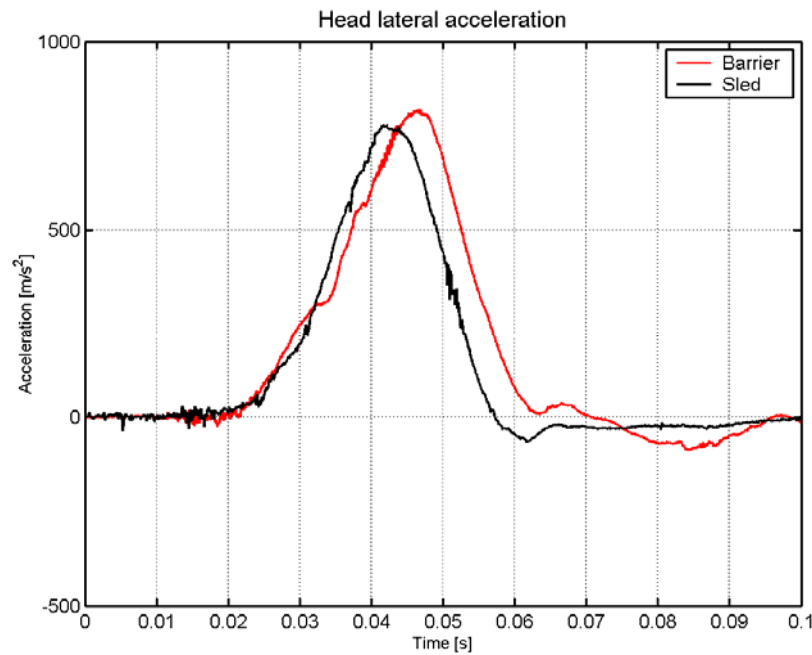
Sled Testing IIHS



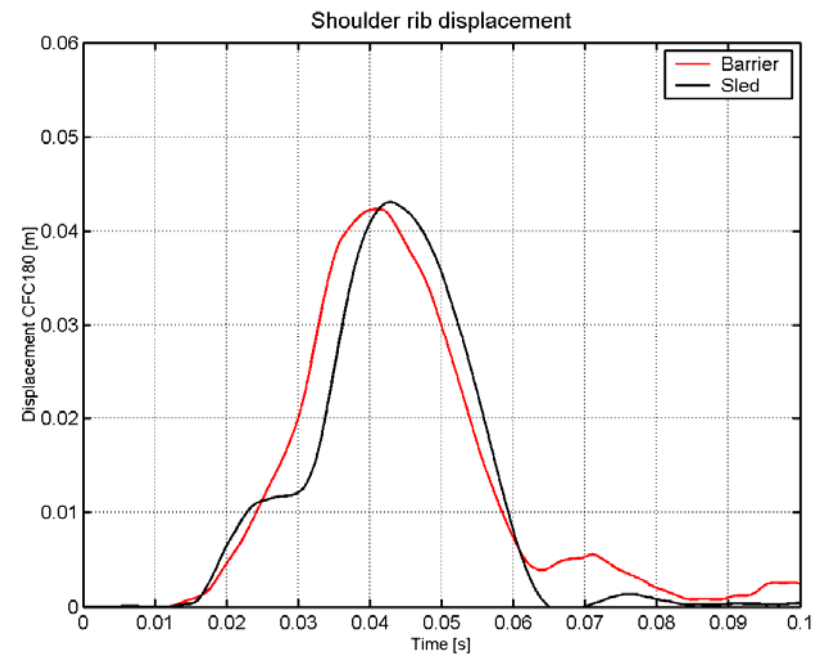
- Velocity vs. time
 - black = sled test
 - red = full scale test
- ◀ door trim on armrest
- ▼ door trim at pelvis level



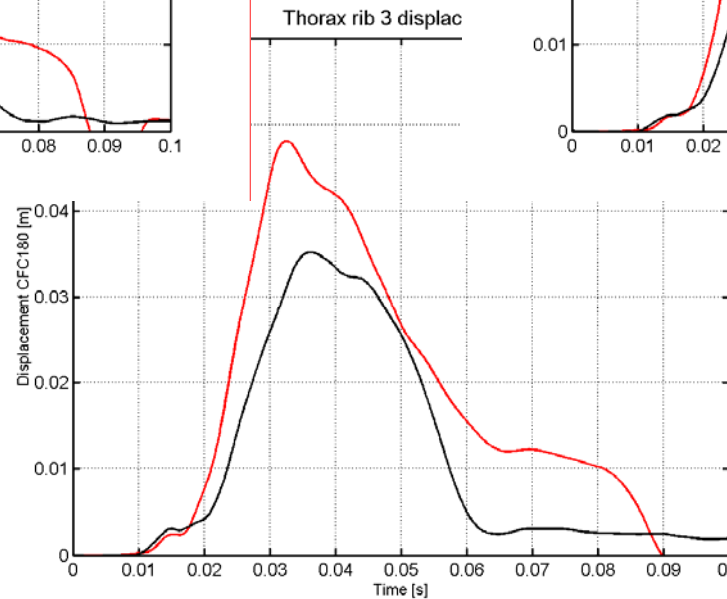
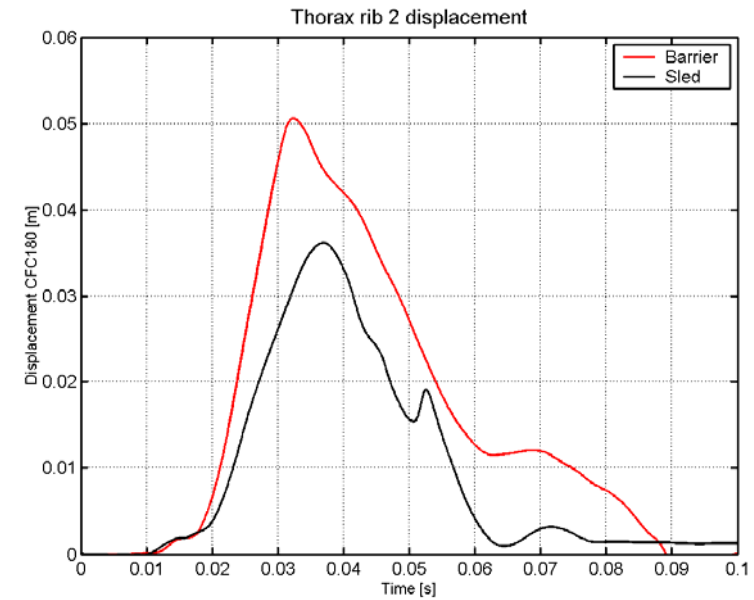
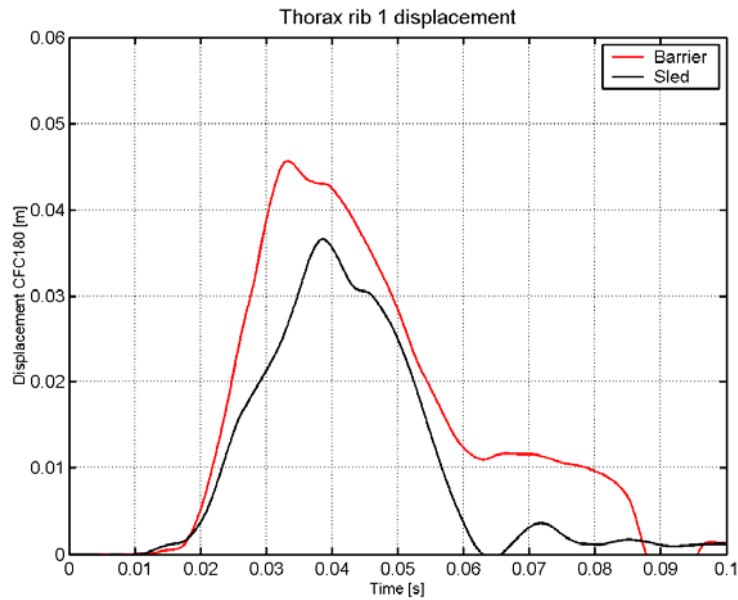
Sled Testing IIHS



- Injury values
 - black = sled test
 - red = full scale test
- ◀ head lateral acceleration
- ▼ shoulder rib displacement

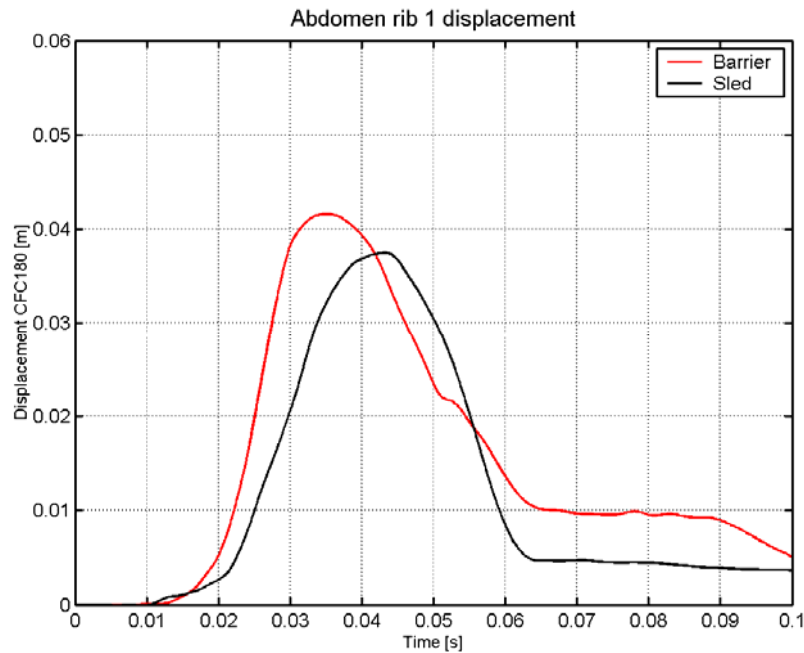


Sled Testing IIHS

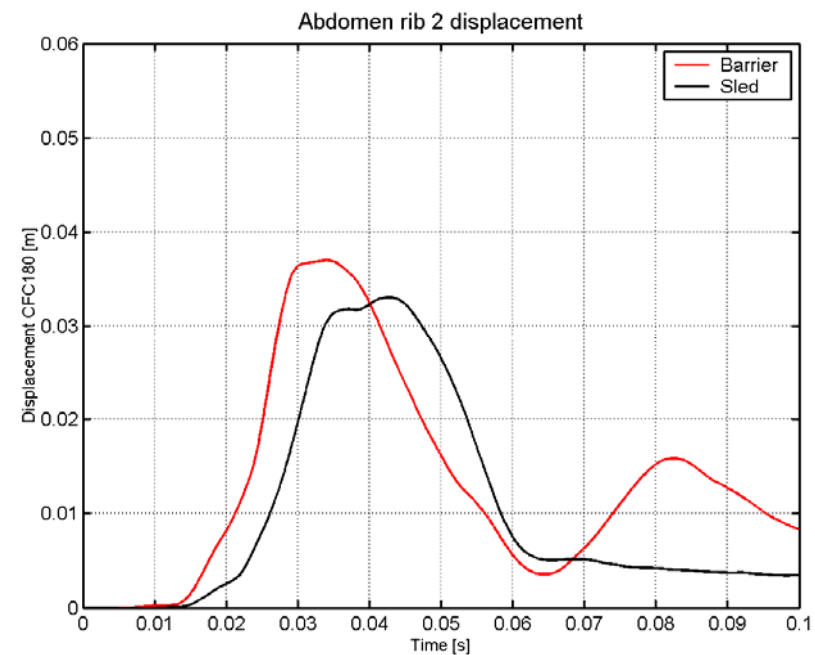


left to right:
upper – lower –middle thorax rib

Sled Testing IIHS



- Injury values
 - black = sled test
 - red = full scale test
- ◀ abdomen rib 1
- ▼ abdomen rib 2



Sled Testing IIHS

- Conclusions sled to barrier correlation:
 - correlation of upper body region good
 - correlation other parts good / acceptable
 - timing of all signals OK
 - tool can be used to fill in the gap between numerical models and full scale test with confidence



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Conclusions

- TASS Side Impact Methodology is an efficient method for systems integration
- All technologies are available at TASS